

WATER RESOURCES DEVELOPMENT PROJECT

**OPERATION AND MAINTENANCE  
MANUAL**

FOR

STABILIZATION OF RIVER BANKS

**AMESBURY, MASSACHUSETTS**

**POWWOW AND MERRIMACK RIVERS**



DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
WALTHAM, MASS.

OCTOBER 1978

OPERATION AND MAINTENANCE MANUAL  
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POWWOW AND MERRIMACK RIVERS  
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FOREWORD

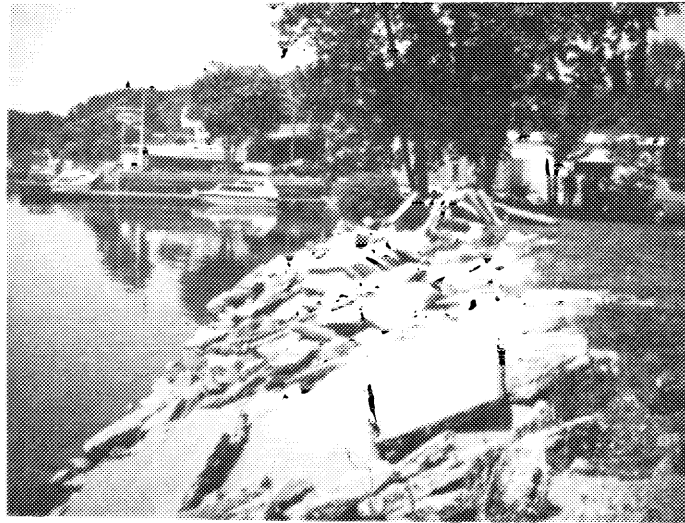
The successful functioning of bank stabilization works is not assured solely by the construction of stone protection and gabions along the river bank. If the system is to perform the functions for which it was designed, it must be carefully maintained not only during periods of normal river stages, but also subsequent flood periods.

The need for proper maintenance cannot be too highly stressed in view of the fact that large damages may be incurred through operating failure of a critical element in flood time, caused by deterioration or damage that would have been eliminated by proper maintenance.

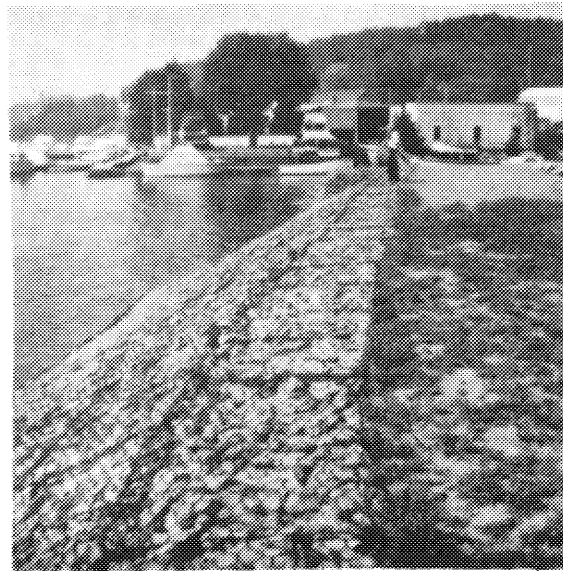
Necessary maintenance and proper operation require that responsible local persons have a thorough understanding of the functions of the various units of the system and the recommended methods of maintaining the system and operating it during flood emergencies. It is the purpose of this manual to provide complete information so that all parties may fully understand their responsibilities in maintaining and operating the flood protection system in accordance with the regulations prescribed by the Secretary of the Army as amplified by this manual.

The general flood control Regulations for Maintenance and Operation of Flood Control Works quoted herein were approved by the Acting Secretary of War on 9 August 1944. Upon establishment of the Department of Defense the improvement of rivers and harbors and other waterways for flood control and other purposes, formerly under the jurisdiction of the Secretary of War, became the responsibility of the Secretary of the Army. Reference therein to the Secretary of War and War Department shall be construed to mean, respectively, the Secretary of the Army and the Department of the Army. Where reference is made to the District Engineer in the Regulations included in this manual, it shall be construed to mean the Division Engineer, New England Division, Corps of Engineers.

STABILIZATION OF RIVER BANKS  
PICTURES BEFORE AND AFTER



BEFORE

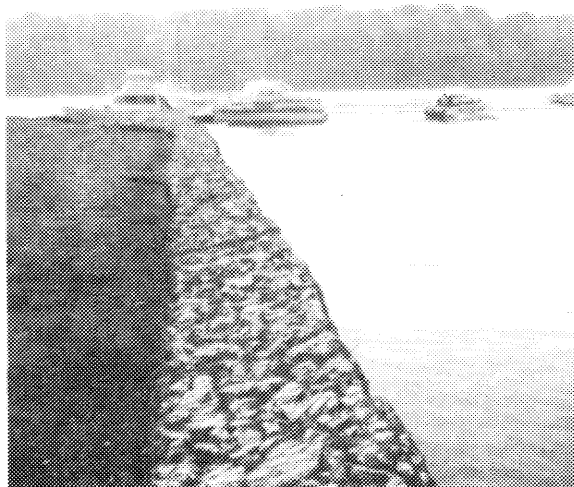


AFTER

STABILIZATION OF RIVER BANKS  
PICTURES BEFORE AND AFTER



BEFORE



AFTER

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## SECTION I

### INTRODUCTION

#### 1. AUTHORIZATION

Construction of the existing bank stabilization project at Amesbury, Massachusetts was authorized by the Chief of Engineers on 21 January 1975 pursuant to the authority contained in Section 14 of the 1946 Flood Control Act, as amended.

#### 2. LOCATION

The project is located at Alliance Park in the town of Amesbury, Massachusetts at the confluence of the Powwow River with the Merrimack River. The town of Amesbury is situated thirty-eight miles north of Boston near the convergence of Routes 95, 110 and 495. At the project location the Merrimack River flows in a west-east direction and the Powwow River flows in a north-south direction.

#### 3. DESCRIPTION OF DAMAGE

Combined actions of tides, waves and ice had resulted in a significant amount of erosion of the rivers' banks and subsequent uprooting of trees, threatening the long-term existence of Alliance Park as a recreation area. An attempt to control this erosion had been initiated by dumping unsightly pieces of broken sidewalk and miscellaneous stone on portions of the riverbank where sloughing had occurred.

#### 4. DESCRIPTION OF PROJECT

The project consists of a 10-foot high gabion seawall extending from the Main Street Bridge approximately 230 feet along the Powwow River-Alliance Park perimeter and continuing as a gabion revetment for approximately 250 feet along the Merrimack River-Alliance Park perimeter.

#### 5. PROTECTION PROVIDED

The gabion seawall and revetment will prevent further erosion of the riverbanks along the perimeter of Alliance Park.

## 6. CONSTRUCTION HISTORY

Construction of this bank stabilization project was initiated in October 1977 and was completed in June 1978. The project was constructed by Midway Excavators, Inc. of South Hampton, New Hampshire. The Federal cost of the project was approximately \$78,000.

## 7. PLANS

A reduced size set of drawings showing the project as actually constructed is included as Appendix D.

## SECTION II

### LOCAL COOPERATION REQUIREMENTS

#### 1. FLOOD CONTROL ACTS

Section 14 of the 1946 Flood Control Act, as amended, provides that no money appropriated under authority of this Act shall be expended on the construction of any project until States, political subdivisions, thereof, or other responsible local agencies have provided written assurances to the Army that they will:

(a) Provide without cost to the United States all lands, easements, rights-of-way, utility relocations, land alterations, and highway or highway bridge construction and alterations necessary for project construction.

(b) Hold and save the Government free from damages due to the construction and subsequent maintenance of the project, except for damages attributable to the fault or negligence of the United States or its contractors.

(c) Maintain and operate the project after completion without cost to the United States in accordance with regulations prescribed by the Secretary of the Army.

(d) Assume full responsibility for all project costs in excess of the Federal cost limitation of \$250,000.

(e) Prevent future encroachment which might interfere with the proper functioning of the project.

#### 2. ASSURANCES

On 25 October 1976, the State of Massachusetts executed the Assurances described above. A copy of the formal assurances is included as Appendix B.



### SECTION III

#### RIVERBANK STABILIZATION WORK

##### 1. DESCRIPTION

The riverbank stabilization work accomplished by the Corps of Engineers consists of clearing and grubbing, excavation, random and gravel fills, stone protection, approximately 230 feet of 10-foot high gabion seawall and 250 feet of gabion revetment, topsoiling, seeding and rerouting a short length of 8-inch water main pipe.

##### 2. MAINTENANCE

Paragraph 208.10(g)(1) of the prescribed regulations set forth rules for the maintenance of channels and floodways. These rules are quoted below, followed by brief comments on the particular applicability of these rules to the Merrimack and Powwow River project.

"Channels and floodways.- (1) Maintenance. - Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

"(1) The channel or floodway is clear of debris, weeds and wild growth."

All debris and growth which tend to restrict the channel shall be removed promptly.

"(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments."

Dumping of waste materials or any types of encroachment on the channel shall be prohibited and prompt steps shall be taken to remove or have removed any such encroachments.

"(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals."

Shoal areas should be removed, but care should be exercised that slopes of the channel and existing banks are not undercut or gabions damaged. Existence of shoal areas will be apparent from inspections during time of low flow.

"(iv) Banks are not being damaged by rain or wave wash and that no sloughing of bank has occurred."

Banks damaged by rain or wave wash or sloughing shall be repaired promptly, using gravel and stone similar to that used in their original construction.

"(v) Riprap sections and deflection dikes and walls are in good condition."

Stonefill slope protection must be maintained in good condition to resist erosion. Any loss of stone due to slides, erosion severed gabion wire or vandalism must be promptly replaced. Periodic checks should be made of the stone slope protection, movement or loss of stone and prompt corrective action taken.

"(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works."

Such inspection shall be made at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes.

### 3. OPERATION

Paragraph 208.10(g)(2) of the prescribed regulations gives rules for operation of channels and floodways. These rules which are quoted below are self-explanatory and require no amplification with regard to the project except that the protective works relate to one bank of each river.

"(2) Operation. The banks of the rivers shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired."

## SECTION IV

### GENERAL REGULATIONS

#### 1. PURPOSE OF THIS MANUAL

The purpose of this Manual is to present detailed information to be used as a guide in complying with "Flood Control Regulations - Maintenance and Operation of Flood Control Works" as approved by the Acting Secretary of War on 9 August 1944, and published in this volume as Appendix A. In executing assurances of local cooperation, the Town has agreed to maintain and operate the completed works in accordance with those regulations. The regulations are intended to cover all local protection projects constructed by the Department throughout the United States, are general in nature, and obviously cannot give detailed instructions for the maintenance and operation of a specific project. The details set forth in this Manual for maintenance and operation of the Amesbury project are intended to supplement the regulations to permit obtaining all the benefits and protection against floods for which the project was designed. Failure to maintain and operate the project as required by the regulations and as detailed herein can cause severe property losses and can result in a irreparable loss of confidence in the bank protection system by citizens who have invested their funds on the basis of the protection which it provides.

#### 2. GENERAL RULES AND REGULATIONS

Paragraph 208.10 (a) of the regulations prescribed by the Secretary of War gives general rules for the maintenance and operation of structures and facilities constructed by the United States for local flood protection. Applicable portions are quoted below to avoid the necessity for cross reference and are further defined by remarks under each quotation.

"(1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits."

These requirements cannot be overstressed, and the Town authorities must take adequate provisions for funds, personnel, equipment and materials to allow for the proper maintenance and operation of the flood protective works.

"(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the 'Superintendent,' who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during the periods of low water, all without cost to the United States."

The committee should be composed of competent members, preferably men experienced in engineering or construction work of a nature similar to the flood protection works. The committee must be given broad authority to carry out its responsibilities. The name, address and office and home telephone numbers of the Superintendent, and any changes thereof, shall be promptly furnished the Division Engineer.

"(3) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the rights-of-way for the protective facilities."

The disposal of rubbish, erection of fences, or barriers, or any form of trespassing on the project shall be prohibited.

"(4) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the War Department or his authorized representatives that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with the standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering

practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work."

Any contemplated improvements or alterations as outlined above must be submitted to the U.S. Army Engineer Division, Waltham, Massachusetts, and the approval of the Division engineer obtained prior to the Town authorizing the work. All requests for approval shall be in writing and complete drawings in duplicate, one set of which shall be in reproducible form, must be submitted along with a full description of the work intended. The Town will be held responsible for obtaining prior approval from the Corps of Engineers for any improvements or alterations proposed by itself, private parties or any public parties. The Town shall furnish the Division Engineer as-built drawings, in duplicate, of the completed work.

"(5) It shall be the duty of the Superintendent to submit a semi-annual report to the District Engineer covering inspection, maintenance, and operation of the protective works."

See paragraph 5 of this SECTION for instructions on submitting reports.

"(6) The District Engineer or his authorized representatives shall have access at all times to all portions of the protective works."

The Division Engineer or his representatives will make periodic inspections of the protective works to determine if the project is being properly maintained and operated by the Town.

"(7) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made."

The Town should maintain the facilities and keep them in good repair and not wait for the Division Engineer to call such matters to its attention. Upon request, the Division Office will advise the Town how to make any major repairs to the facilities.

"(8) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods."

The Town should formulate plans and negotiate agreements with local organizations and companies, who are operating facilities connected with the protective works, to insure that their activities will be properly coordinated with the Superintendent's organization during flood periods.

"(9) The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations."

The flood control committee should familiarize itself with the contents of this manual. The Town authorities are encouraged to call on the Division Office of the Corps of Engineers for any additional advice or instructions required by them in carrying out the Town's obligations for maintaining and operating the flood protection facilities.

### 3. MAINTENANCE.

a. The work "maintenance" as used in this manual applies to the upkeep, repair and care of the work constructed by the United States and turned over to the Town of Amesbury, Massachusetts. If the work is neglected there will be deterioration and possible failure in flood time when there is dire need of dependable protection.

b. Satisfactory and dependable operation depends on constant maintenance. The organization that performs maintenance must be familiar with various parts of the system and will be in a position to use them effectively in time of stress.

c. Maintenance includes regular inspection of the entire system. The purpose of an inspection is to detect any deterioration or faulty operation that indicates a need for repair or replacement.

d. Each of the major features of the project is discussed separately. Particular emphasis is placed on those points which, based on experience with special projects features, require special attention.

### 4. OPERATION.

a. Operation in this manual refers to the actual use of the various features of the protection works during flood periods. It is intended that the procedure outlined herein will be sufficient to insure protection from floods to the design stage. However, advice relative to operation may be obtained at any time from the Engineering Division of the New England Division Office.

b. When abnormal river flows and stages are expected it is important that the Superintendent make immediate decisions and take prompt action and that he have the authority to carry out his decisions.

c. To insure correct operation it is essential that at least one person (preferably 2 or 3) be familiar with all phases of the flood protection works, know just what supplies and transport are on hand, and know what men and tools can be mobilized for the patrolling and repair work.

## 5. REPORTS

a. The regulations prescribed by the Secretary of the Army call for semi-annual reports to be submitted by the Superintendent to the Division Engineer, covering inspection, maintenance and operation. Inspection of the flood protective facilities shall be made immediately prior to flood seasons, immediately following floods, and otherwise at intervals not exceeding 90 days as required by the regulations.

b. To assist the Superintendent in making his inspection and reports, sample forms have been prepared and are included in Appendix C. The Superintendent shall have additional copies printed for use in submitting his reports.

c. The semi-annual reports shall be submitted in triplicate to the Division Engineer each February and August. The reports will be submitted in letter form with copies of the inspection forms covering the inspections made during the period of the report. The reports shall cover the following points:

(1) A description of the maintenance work performed in the preceding six months.

(2) The number and classification of men working on maintenance, regularly and intermittently.

(3) Description of any work performed by contract on the repair or improvement of the project.

(4) Description of use or operation of the system during the period being reported.

(5) Suggestions relative to public cooperation and comments concerning public sentiment on the protection obtained are considered pertinent and desirable data for inclusion in the report, but such data are not required.

APPENDIX A

REGULATIONS PRESCRIBED BY THE  
SECRETARY OF WAR



## TITLE 11—NAVIGATION AND NAVIGABLE WATERS

### Chapter 11—Corps of Engineers, War Department

#### PART 108—FLOOD CONTROL REGULATIONS MAINTENANCE AND OPERATION OF FLOOD CONTROL WORKS

Pursuant to the provisions of section 3 of the Act of Congress approved June 22, 1936, as amended and supplemented (49 Stat. 1071; 50 Stat. 877; and 55 Stat. 634; 33 U. S. C. 701c; 701c-1), the following regulations are hereby prescribed to govern the maintenance and operation of flood control works:

**§ 108.10 Local flood protection works; maintenance and operation of structures and facilities.**—(a) General. (1) The structures and facilities constructed by the United States for local flood protection shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits.

(2) The State, political subdivision thereof, or other responsible local agency, which furnished assurance that it will maintain and operate flood control works in accordance with regulations prescribed by the Secretary of War, as required by law, shall appoint a permanent committee consisting of or headed by an official hereinafter called the "Superintendent," who shall be responsible for the development and maintenance of, and directly in charge of, an organization responsible for the efficient operation and maintenance of all of the structures and facilities during flood periods and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States.

(3) A reserve supply of materials needed during a flood emergency shall be kept on hand at all times.

(4) No encroachment or trespass which will adversely affect the efficient operation or maintenance of the project works shall be permitted upon the right-of-way for the protective facilities.

(5) No improvement shall be passed over, under, or through the walls, levees, improved channels or floodways, nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the War Department or his authorized representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities. Such improvements or alterations as may be found to be desirable and permissible under the above determination shall be constructed in accordance with standard engineering practice. Advice regarding the effect of proposed improvements or alterations on the functioning of the project and information concerning methods of construction acceptable under standard engineering practice shall be obtained from the District Engineer or, if otherwise obtained, shall be submitted for his approval. Drawings or prints showing such improvements or alterations as finally constructed shall be furnished the District Engineer after completion of the work.

(6) It shall be the duty of the superintendent to submit a semiannual report to the District Engineer covering inspection, maintenance, and operation of the protective works.

(7) The District Engineer or his authorized representative shall have access at all times to all portions of the protective works.

(8) Maintenance measures or repairs which the District Engineer deems necessary shall be promptly taken or made.

(9) Appropriate measures shall be taken by local authorities to insure that the activities of all local organizations operating public or private facilities connected with the protective works are coordinated with those of the Superintendent's organization during flood periods.

(10) The War Department will furnish local interests with an Operation and Maintenance Manual for each completed project, or separate useful part thereof, to assist them in carrying out their obligations under these regulations.

(b) Levees.—(1) Maintenance. The Superintendent shall provide at all times such maintenance as may be required to insure serviceability of the structures in time of flood. Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of the grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees. Periodic inspections shall be made by the Superintendent to insure that the above maintenance measures are being effectively carried out and, further, to be certain that:

(i) No unusual settlement, sloughing, or material loss of grade or levee cross section has taken place;

(ii) No caving has occurred on either the land side or the river side of the levee which might affect the stability of the levee section;

(iii) No seepage, saturated areas, or sand boils are occurring;

(iv) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged;

(v) Drains through the levees and gates on said drains are in good working condition;

(vi) No revetment work or riprap has been displaced, washed out, or removed;

(vii) No action is being taken, such as burning grass and weeds during inappropriate seasons, which will retard or destroy the growth of sod;

(viii) Access roads to and on the levee are being properly maintained;

(ix) Cattle guards and gates are in good condition;

(x) Crown of levee is shaped so as to drain readily, and roadway thereon, if any, is well shaped and maintained;

(xi) There is no unauthorized grazing or vehicular traffic on the levees;

(xii) Encroachments are not being made on the levee right-of-way which might endanger the structure or hinder its proper and efficient functioning during times of emergency.

Such inspections shall be made immediately prior to the beginning of the flood season; immediately following each major high water period, and otherwise at intervals not exceeding 90 days, and such intermediate times as may be necessary to insure the best possible care of

the levee. Immediate steps will be taken to correct dangerous conditions disclosed by such inspections. Regular maintenance repair measures shall be accomplished during the appropriate season as scheduled by the Superintendent.

(2) Operation. During flood periods the levee shall be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope and to be certain that:

(i) There are no indications of slides or sloughs developing;

(ii) Wave wash or scouring action is not occurring;

(iii) No low reaches of levee exist which may be overtopped;

(iv) No other conditions exist which might endanger the structure.

Appropriate advance measures will be taken to insure the availability of adequate labor and materials to meet all contingencies. Immediate steps will be taken to control any condition which endangers the levee and to repair the damaged section.

(c) Flood walls.—(1) Maintenance. Periodic inspections shall be made by the Superintendent to be certain that:

(i) No seepage, saturated areas, or sand boils are occurring;

(ii) No undue settlement has occurred which affects the stability of the wall or its water tightness;

(iii) No trees exist, the roots of which might extend under the wall and offer accelerated seepage paths;

(iv) The concrete has not undergone cracking, chipping, or breaking to an extent which might affect the stability of the wall or its water tightness;

(v) There are no encroachments upon the right-of-way which might endanger the structure or hinder its functioning in time of flood;

(vi) Care is being exercised to prevent accumulation of trash and debris adjacent to walls, and to insure that no fires are being built near them;

(vii) No bank caving conditions exist riverward of the wall which might endanger its stability;

(viii) Toe drainage systems and pressure relief wells are in good working condition, and that such facilities are not becoming clogged.

Such inspections shall be made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days. Measures to eliminate encroachments and effect repairs found necessary by such inspections shall be undertaken immediately. All repairs shall be accomplished by methods acceptable in standard engineering practice.

(2) Operation. Continuous patrol of the wall shall be maintained during flood periods to locate possible leakage at monolith joints or seepage underneath the wall. Floating plant or boats will not be allowed to lie against or tie up to the wall. Should it become necessary during a flood emergency to pass anchor cables over the wall, adequate measures shall be taken to protect the concrete and construction joints. Immediate steps shall be taken to correct any condition which endangers the stability of the wall.

(d) Drainage structures.—(1) Maintenance. Adequate measures shall be taken to insure that inlet and outlet channels are kept open and that trash, drift, or debris is not allowed to accumulate near drainage structures. Flap gates and manually operated gates and valves on

drainage structures shall be examined, oiled, and trial operated at least once every 90 days. Where drainage structures are provided with stop log or other emergency closures, the condition of the equipment and its housing shall be inspected regularly and a trial installation of the emergency closure shall be made at least once each year. Periodic inspections shall be made by the Superintendent to be certain that:

(i) Pipes, gates, operating mechanism, riprap, and headwalls are in good condition;

(ii) Inlet and outlet channels are open;

(iii) Care is being exercised to prevent the accumulation of trash and debris near the structures and that no fires are being built near bituminous coated pipes;

(iv) Erosion is not occurring adjacent to the structure which might endanger its water tightness or stability.

Immediate steps will be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections.

(2) *Operation.* Whenever high water conditions impend, all gates will be inspected a short time before water reaches the invert of the pipe and any object which might prevent closure of the gate shall be removed. Automatic gates shall be closely observed until it has been ascertained that they are securely closed. Manually operated gates and valves shall be closed as necessary to prevent inflow of flood water. All drainage structures in levees shall be inspected frequently during floods to ascertain whether seepage is taking place along the lines of their contact with the embankment. Immediate steps shall be taken to correct any adverse condition.

(c) *Closure structures.*—(1) *Maintenance.* Closure structures for traffic openings shall be inspected by the superintendent every 90 days to be certain that:

(i) No parts are missing;

(ii) Metal parts are adequately covered with paint;

(iii) All movable parts are in satisfactory working order;

(iv) Proper closure can be made promptly when necessary;

(v) Sufficient materials are on hand for the erection of sand bag closures and that the location of such materials will be readily accessible in times of emergency.

Tools and parts shall not be removed for other use. Trial erections of one or more closure structures shall be made once each year, alternating the structures chosen so that each gate will be erected at least once in each 3-year period. Trial erection of all closure structures shall be made whenever a change is made in key operating personnel. Where railroad operation makes trial erection of a closure structure infeasible, rigorous inspection and drill of operating personnel may be substituted therefor. Trial erection of sand bag closures is not required. Closure materials will be carefully checked prior to and following flood periods, and damaged or missing parts shall be repaired or replaced immediately.

(2) *Operation.* Erection of each movable closure shall be started in sufficient time to permit completion before flood waters reach the top of the structure sill. Information regarding the proper method of erecting each individual closure structure, together with an estimate of the time required by an experienced crew to complete its erection will be given

in the Operation and Maintenance Manual which will be furnished local interests upon completion of the project. Closure structures will be inspected frequently during flood periods to ascertain that no undue leakage is occurring and that drains provided to care for ordinary leakage are functioning properly. Boats or floating plant shall not be allowed to tie up to closure structures or to discharge passengers or cargo over them.

(f) *Pumping plants.*—(1) *Maintenance.* Pumping plants shall be inspected by the Superintendent at intervals not to exceed 30 days during flood seasons and 90 days during off-flood seasons to insure that all equipment is in order for instant use. At regular intervals, proper measures shall be taken to provide for cleaning plant, buildings, and equipment, repainting as necessary, and lubricating all machinery. Adequate supplies of lubricants for all types of machines, fuel for gasoline or diesel powered equipment, and flash lights or lanterns for emergency lighting shall be kept on hand at all times. Telephone service shall be maintained at pumping plants. All equipment, including switch gear, transformers, motors, pumps, valves, and gates shall be trial operated and checked at least once every 90 days. Megger tests of all insulation shall be made whenever wiring has been subjected to undue dampness and otherwise at intervals not to exceed one year. A record shall be kept showing the results of such tests. Wiring disclosed to be in an unsatisfactory condition by such tests shall be brought to a satisfactory condition or shall be promptly replaced. Diesel and gasoline engines shall be started at such intervals and allowed to run for such length of time as may be necessary to insure their serviceability in times of emergency. Only skilled electricians and mechanics shall be employed on tests and repairs. Operating personnel for the plant shall be present during tests. Any equipment removed from the station for repair or replacement shall be returned or replaced as soon as practicable and shall be trial operated after reinstallation. Repairs requiring removal of equipment from the plant shall be made during off-flood seasons insofar as practicable.

(2) *Operation.* Competent operators shall be on duty at pumping plants whenever it appears that necessity for pump operation is imminent. The operator shall thoroughly inspect, trial operate, and place in readiness all plant equipment. The operator shall be familiar with the equipment manufacturers' instructions and drawings and with the "Operating Instructions" for each station. The equipment shall be operated in accordance with the above-mentioned "Operating Instructions" and care shall be exercised that proper lubrication is being supplied all equipment, and that no overheating, undue vibration or noise is occurring. Immediately upon final recession of flood waters, the pumping station shall be thoroughly cleaned, pump house sumps flushed, and equipment thoroughly inspected, oiled and greased. A record or log of pumping plant operation shall be kept for each station, a copy of which shall be furnished the District Engineer following each flood.

(g) *Channels and floodways.*—(1) *Maintenance.* Periodic inspections of improved channels and floodways shall be made by the Superintendent to be certain that:

(i) The channel or floodway is clear of debris, weeds, and wild growth;

(ii) The channel or floodway is not being restricted by the depositing of waste materials, building of unauthorized structures or other encroachments;

(iii) The capacity of the channel or floodway is not being reduced by the formation of shoals;

(iv) Banks are not being damaged by rain or wave wash, and that no sloughing of banks has occurred;

(v) Riprap sections and deflection dikes and walls are in good condition;

(vi) Approach and egress channels adjacent to the improved channel or floodway are sufficiently clear of obstructions and debris to permit proper functioning of the project works.

Such inspections shall be made prior to the beginning of the flood season and otherwise at intervals not to exceed 90 days. Immediate steps will be taken to remedy any adverse conditions disclosed by such inspections. Measures will be taken by the Superintendent to promote the growth of grass on bank slopes and earth deflection dikes. The Superintendent shall provide for periodic repair and cleaning of debris basins, check dams, and related structures as may be necessary.

(2) *Operation.* Both banks of the channel shall be patrolled during periods of high water, and measures shall be taken to protect those reaches being attacked by the current or by wave wash. Appropriate measures shall be taken to prevent the formation of jams of ice or debris. Large objects which become lodged against the bank shall be removed. The improved channel or floodway shall be thoroughly inspected immediately following each major high water period. As soon as practicable thereafter, all snags and other debris shall be removed and all damage to banks, riprap, deflection dikes and walls, drainage outlets, or other flood control structures repaired.

(h) *Miscellaneous facilities.*—(1) *Maintenance.* Miscellaneous structures and facilities constructed as a part of the protective works and other structures and facilities which function as a part of, or affect the efficient functioning of the protective works, shall be periodically inspected by the Superintendent and appropriate maintenance measures taken. Damaged or unserviceable parts shall be repaired or replaced without delay. Areas used for ponding in connection with pumping plants or for temporary storage of interior run-off during flood periods shall not be allowed to become filled with silt, debris, or dumped material. The Superintendent shall take proper steps to prevent restriction of bridge openings and, where practicable, shall provide for temporary raising during floods of bridges which restrict channel capacities during high flows.

(2) *Operation.* Miscellaneous facilities shall be operated to prevent or reduce flooding during periods of high water. Those facilities constructed as a part of the protective works shall not be used for purposes other than flood protection without approval of the District Engineer unless designed therefor. (49 Stat. 1571, 50 Stat. 877; and 55 Stat. 638; 33 U.S.C. 701c; 701c-1) (Regs. 9 August 1946, CE SPEWF)

[SEAL]

J. A. ULIO,  
Major General,  
The Adjutant General.

[P. R. Loc. 44-12286; Filed, August 16, 1946;  
9:44 a.m.]

APPENDIX B

ASSURANCES OF LOCAL COOPERATION

AGREEMENT BETWEEN  
THE UNITED STATES OF AMERICA  
AND  
COMMONWEALTH OF MASSACHUSETTS  
FOR LOCAL COOPERATION AT  
THE POWWOW AND MERRIMACK RIVERS  
AMESBURY, MASSACHUSETTS

THIS AGREEMENT entered into this October day of 25, 1976  
by and between the UNITED STATES OF AMERICA (hereinafter called the  
"Government"), represented by the Contracting Officer executing this  
agreement, and the Commonwealth of Massachusetts (hereinafter called  
the "Commonwealth"), acting by the Department of Environmental Quality  
Engineering through its Division of Waterways, and with the approval of  
the Governor,

WITNESSETH THAT:

WHEREAS, construction of the emergency bank protection project  
on the Powwow and Merrimack Rivers (hereinafter called the "Project"),  
was approved on 21 January 1976 by the Chief of Engineers under authority  
of Section 14 of the Flood Control Act of 1946, Public Law 79-526,  
33 U.S.C. 701r, as amended by Section 27 of the Water Resources Develop-  
ment Act of 1974, approved 7 March 1974, Public Law 93-251; and

WHEREAS, The Commonwealth hereby represents that it has the authority  
and capability to furnish the non-Federal cooperations required by the  
Federal legislation authorizing the Project and by other applicable law.

NOW THEREFORE, the parties agree as follows:

1. The Commonwealth agrees that, if the Government shall  
commence construction of the emergency bank protection project  
on the Powwow and Merrimack Rivers in Amesbury, Massachusetts,  
substantially in accordance with approval of the Chief of Engineers,

dated 21 January 1976 under authority of Section 14 of the Flood Control Act of 1946, as amended, it shall in consideration of the Government commencing construction of such Project, fulfill the requirements of non-Federal cooperation to wit:

a. Provide without cost to the United States all lands, easements, and rights-of-way necessary for the construction and maintenance of the project.

b. Hold and save the United States free from damages due to construction works except damages due to fault or negligence of the United States or its contractors.

c. Maintain and operate all works after completion in accordance with regulations prescribed by the Secretary of the Army.

d. Prevent future encroachment which might interfere with proper functioning of the project.

e. Assume responsibility for all costs in excess of the Federal limitation of \$250,000.00 to insure that expenditure of Federal funds will result in a complete and fully effective project.

2. The Commonwealth further agrees to comply with requirements of non-Federal cooperation specified in Section 210 and 305 of Public Law 91-646, 91st Congress, S.1, approved 2 January 1971, known as the "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970", to wit:

a. Fair and reasonable relocation payments and assistance shall be provided to or for displaced persons, as one required to be provided by a Federal agency under Sections 202, 203 and 204 of Public Law 91-646;

b. Relocation assistance programs offering the services described in Section 205 of Public Law 91-646 shall be provided to such displaced persons;

c. Within a reasonable period time prior to displacement, decent, safe and sanitary replacement dwellings will be available to displaced persons in accordance with Sections 205 (c) (3) of Public Law 91-646.

d. In acquiring real property the Commonwealth will be guided to the greatest extent possible under its laws, by the land acquisition policies in Section 301 and the provisions of Section 302 of Public Law 91-646; and

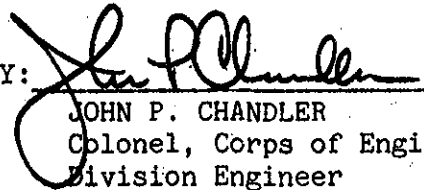
e. Property owners will be paid or reimbursed for necessary expenses as specified in Sections 303 and 304 of Public Law 91-646.

3. The Commonwealth hereby gives the Government a right to enter upon, at reasonable times and in a reasonable manner, lands which the Commonwealth owns or controls, for access to the Project for the purpose of inspection and for the purpose of completing, operating, repairing and maintaining the Project, if such inspection shows that the Commonwealth for any reason is failing to complete, repair and maintain the Project in accordance with the assurances hereunder and has persisted in such failure after a reasonable notice in writing by the Government delivered to Commonwealth Officials. No completion, operation, repair and maintenance by the Government in such event shall operate to relieve the Commonwealth of responsibility to meet its obligations as set forth in paragraph 1 of this Agreement, or to preclude the Government from pursuing any other remedy at law or equity.

4. This Agreement is subject to the approval of the Secretary of the Army.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement  
as of the day and year first above written.

THE UNITED STATES OF AMERICA

BY:   
JOHN P. CHANDLER  
Colonel, Corps of Engineers  
Division Engineer

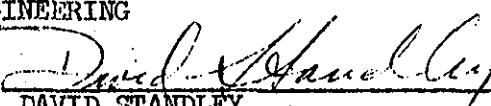
Date: 16 FEB 1977

APPROVED:

  
WOODROW BENGE  
Director of Real Estate

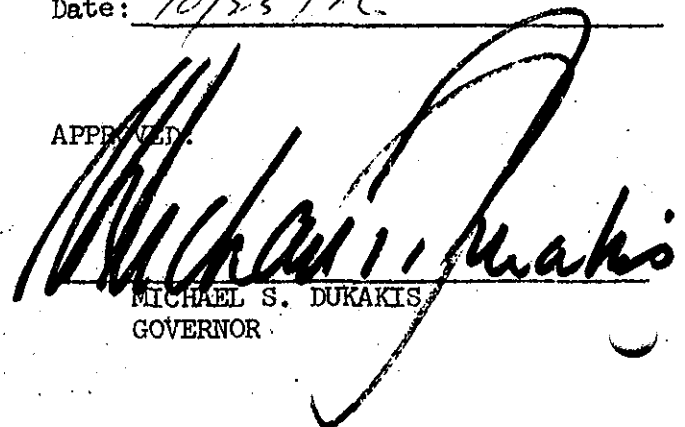
FOR THE SECRETARY OF THE ARMY

THE COMMONWEALTH OF MASSACHUSETTS  
DEPARTMENT OF ENVIRONMENTAL QUALITY  
ENGINEERING

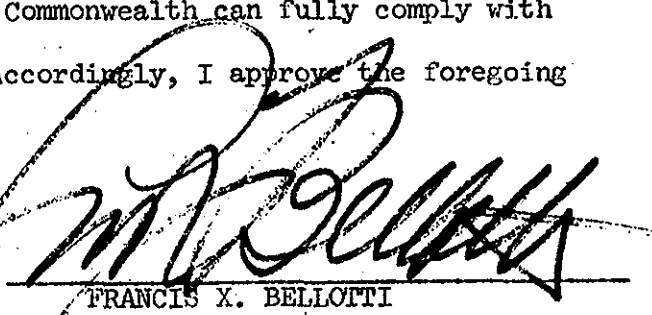
BY:   
DAVID STANDLEY  
COMMISSIONER

Date: 10/25/76

APPROVED:

  
MICHAEL S. DUKAKIS  
GOVERNOR

I have reviewed the foregoing Agreement and have considered the  
effect of Section 221 of the Flood Control Act of 1970, Public Law  
91-611, and I am satisfied that the Commonwealth can fully comply with  
the provisions of said Agreement. Accordingly, I approve the foregoing  
Agreement.

  
FRANCIS X. BELLOTTI  
Attorney General

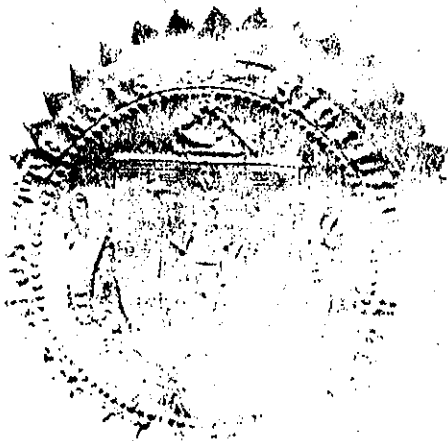
CERTIFICATION

I, Paul Guzzi, do hereby certify that I am Secretary of the Commonwealth of Massachusetts; that David Standley who signed this Agreement on behalf of the Commonwealth of Massachusetts, was then the Commissioner of the Department of Environmental Quality Engineering; that said Agreement was duly signed for and on behalf of the Commonwealth of Massachusetts; and that said Agreement is within the scope of the Commissioner's powers; and that Francis X. Bellotti was Attorney General at the time of his approval.

I further certify that Michael S. Dukakis was Governor of this Commonwealth on the date of approval of this Agreement.

Paul Guzzi  
PAUL GUZZI  
Secretary of the Commonwealth

(State Seal)





APPENDIX C

INSPECTION REPORT FORM

# LOCAL FLOOD PROTECTION PROJECT INSPECTION REPORT

Project:

Maintaining Agency:

Type Inspection:            Semi-Annual Staff            90 Day Interim

River Basin:

Date of Inspection

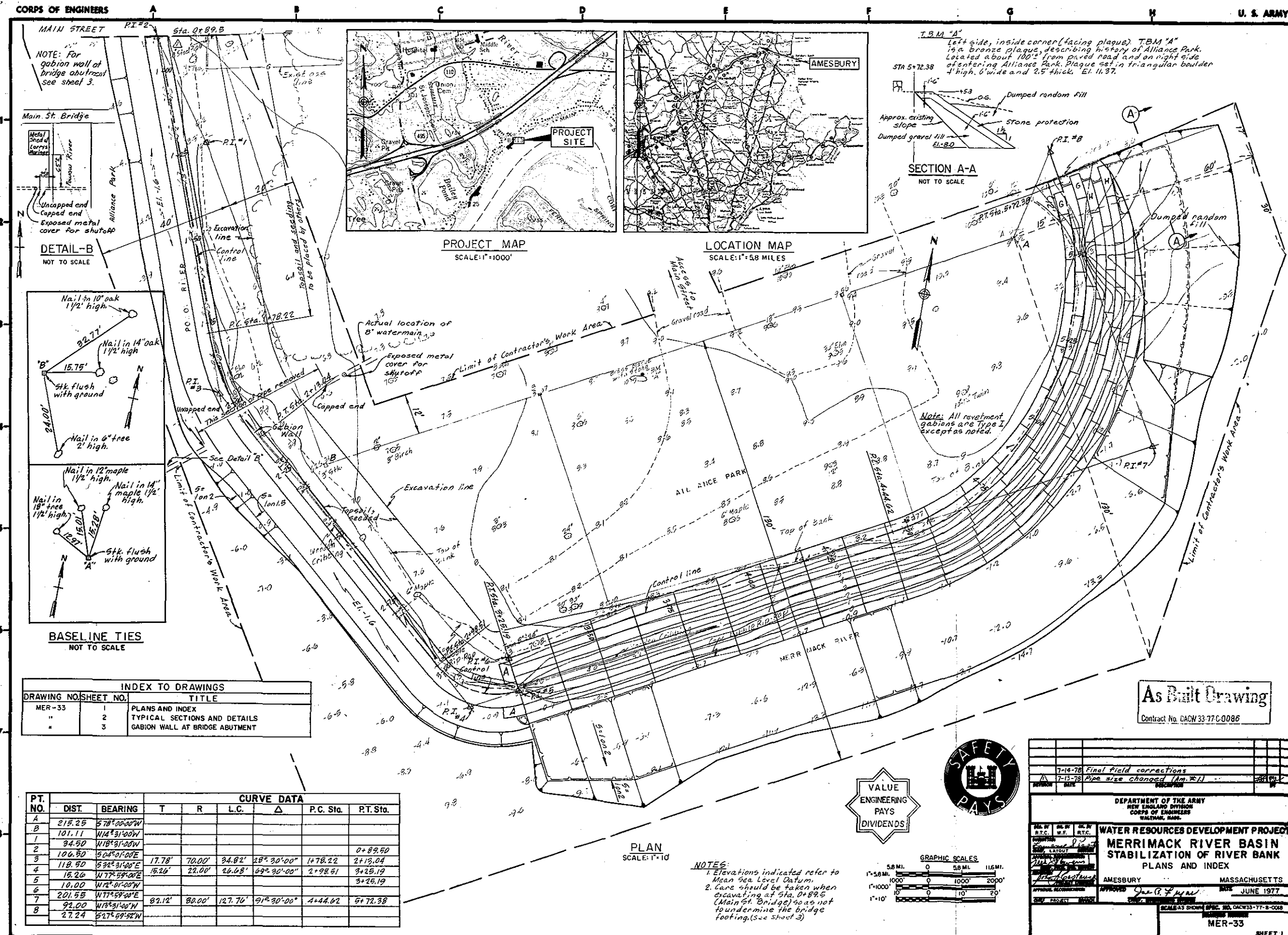
| Feature                                | Sat | Unsat | Deficiencies |
|--|-----|-------|--------------|
| <b>PUMPING STATIONS - STRUCTURES</b>   |     |       |              |
| INTERIOR                               |     |       |              |
| EXTERIOR                               |     |       |              |
| <b>PUMPS - MOTORS - ENGINES</b>        |     |       |              |
| TRIAL OPERATED                         |     |       |              |
| GENERAL CONDITION                      |     |       |              |
| POWER SOURCE                           |     |       |              |
| INSULATION TESTS                       |     |       |              |
| METAL INTAKES/OUTLETS                  |     |       |              |
| GATE VALVES                            |     |       |              |
| <b>GATES - DRAINAGE STRUCTURES</b>     |     |       |              |
| TRIAL OPERATED                         |     |       |              |
| GENERAL CONDITION                      |     |       |              |
| LUBRICATION                            |     |       |              |
| <b>DIKES - DAMS</b>                    |     |       |              |
| GENERAL CONDITION                      |     |       |              |
| SLOPES/EROSION                         |     |       |              |
| SAND BOILS/CAVING                      |     |       |              |
| TRESPASSING                            |     |       |              |
| SLOPE PROTECTION                       |     |       |              |
| DRAINS                                 |     |       |              |
| <b>STOP-LOGS - LOG BOOM</b>            |     |       |              |
| CONDITION OF LOGS                      |     |       |              |
| AVAILABILITY OF LOGS                   |     |       |              |
| HIGHWAY SLOTS                          |     |       |              |
| STORAGE FACILITIES                     |     |       |              |
| <b>CHANNELS - OUTLET WORKS CHANNEL</b> |     |       |              |
| BANKS                                  |     |       |              |
| OBSTRUCTION CONTROL                    |     |       |              |

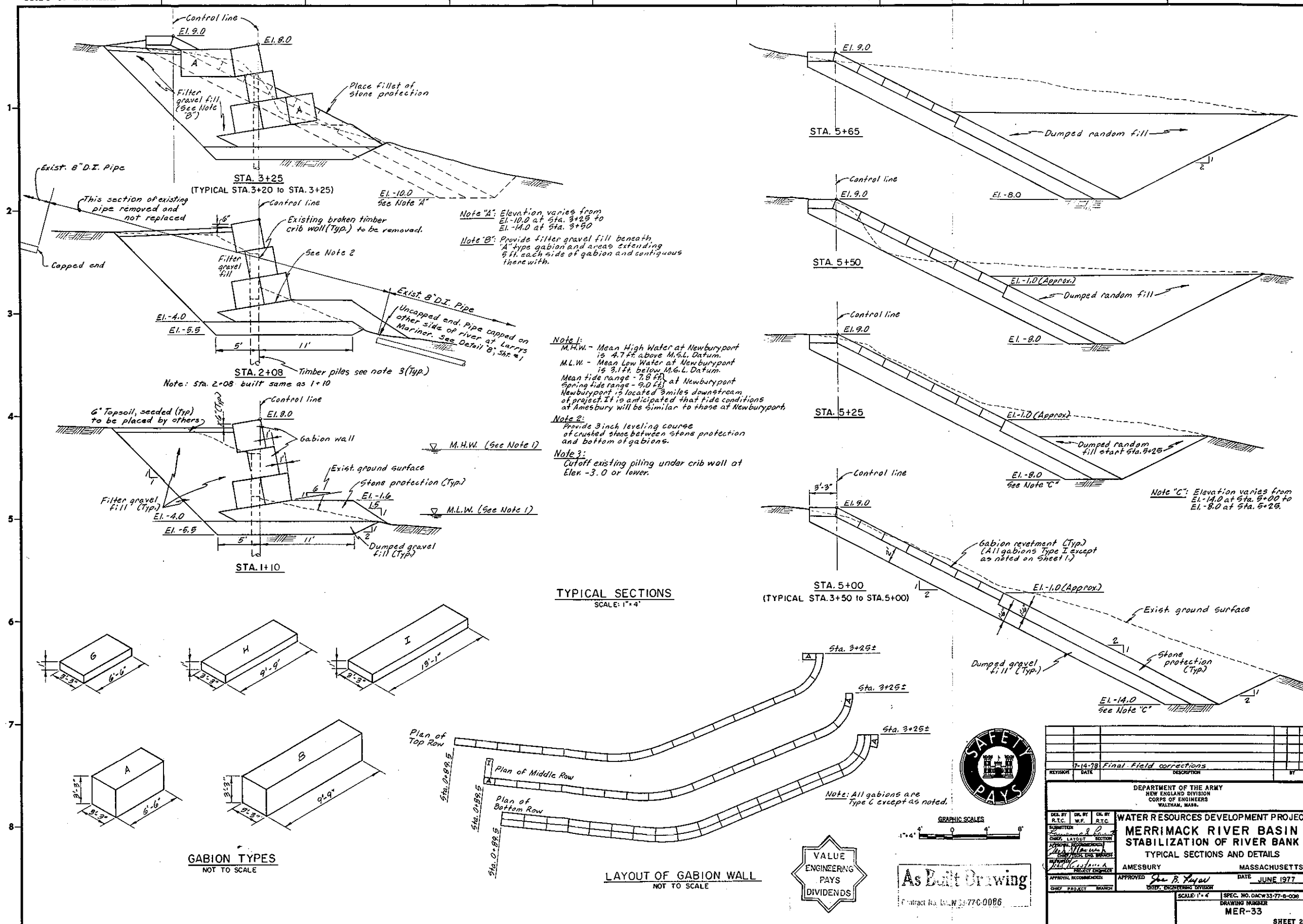
| Feature   | Sat                              | Unsat | Deficiencies |
|---|----------------------------------|-------|--------------|
| <b>CONCRETE STRUCTURES</b>  |                                  |       |              |
| SURFACE   |                                  |       |              |
| SETTLEMENT  |                                  |       |              |
| JOINTS  |                                  |       |              |
| DRAINS  |                                  |       |              |
| <b>MISCELLANEOUS</b>  |                                  |       |              |
| EMERGENCY OPER. PLAN  |                                  |       |              |
| EMERGENCY EQUIPMENT   |                                  |       |              |
| SEMI-ANNUAL REPORT  |                                  |       |              |
|   |                                  |       |              |
|   |                                  |       |              |
| <b>Inspection Party:</b><br><br>  |                                  |       |              |
| <b>Photographs Taken:</b><br><br>   |                                  |       |              |
| <b>Remarks &amp; Additional Comments:</b><br>( Indicate Here Observations, Discussions, Specific Feature Deficiencies, Recommendations and any other pertinent information. Use Continuation Sheet if necessary.)<br><br> |                                  |       |              |
| X ALL APPLICABLE ITEMS. IF UNSAT INDICATE SPECIFIC DEFICIENCIES. INDICATE IF NOT APPLICABLE.  |                                  |       |              |
| DATE  | INSPECTED BY: TYPED NAME & TITLE |       | SIGNATURE    |

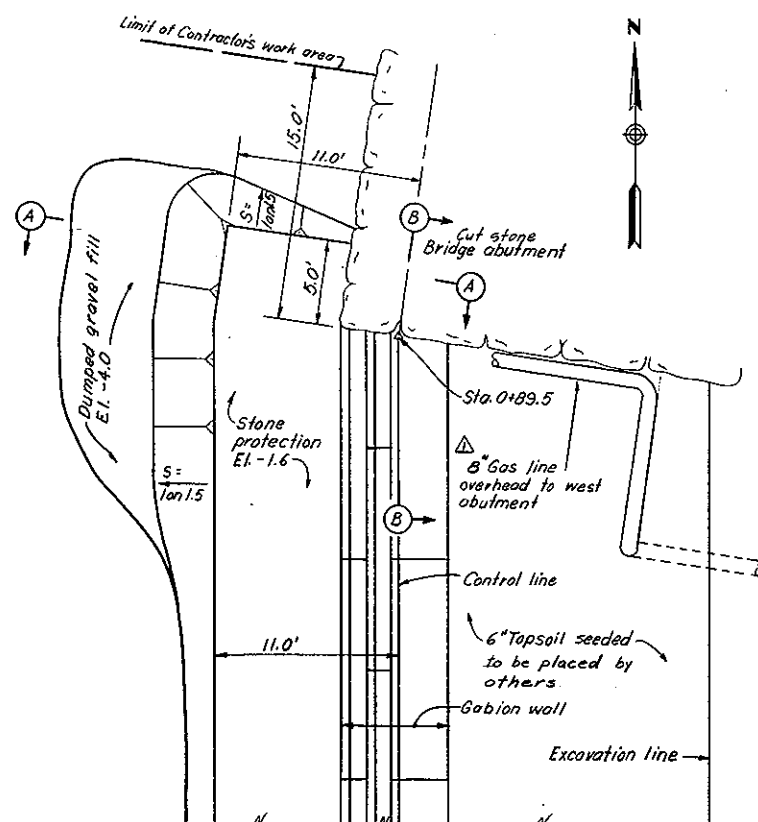
APPENDIX D

AS-BUILT DRAWINGS

| <u>Drawing No.</u> | <u>Sheet No.</u> | <u>Title</u>   |
|--------------------|------------------|--|
| MER-33             |                  | WATER RESOURCES DEVELOPMENT PROJECT<br>MERRIMACK RIVER BASIN<br>STABILIZATION OF RIVER BANK<br>AMESBURY, MASSACHUSETTS |
|                    | 1                | PLANS AND INDEX  |
|                    | 2                | TYPICAL SECTIONS AND DETAILS   |
|                    | 3                | GABION WALL AT BRIDGE ABUTMENT   |

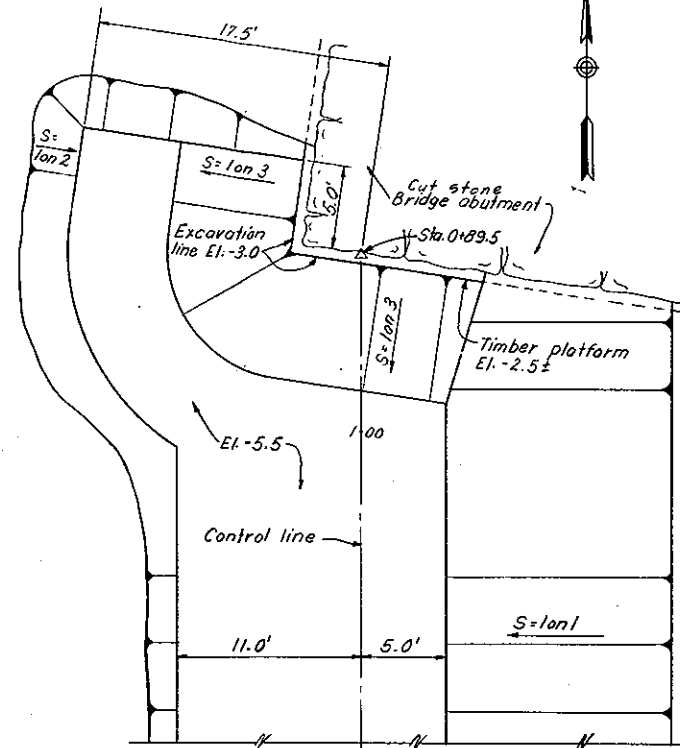






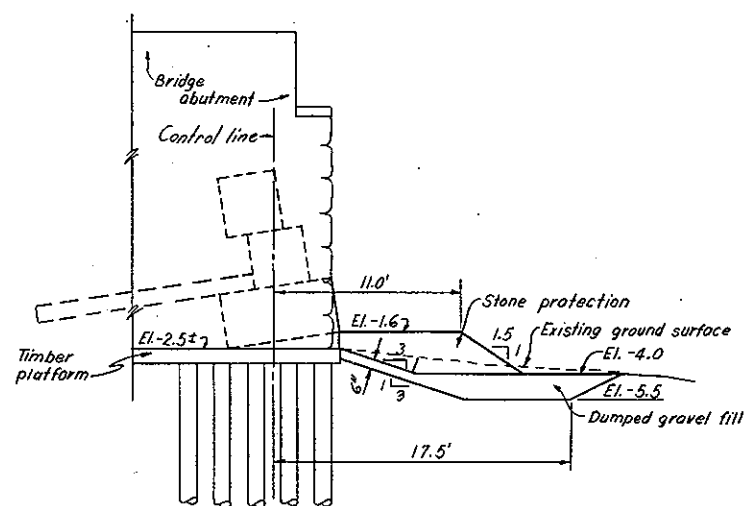
PLAN

SCALE 1" = 4'



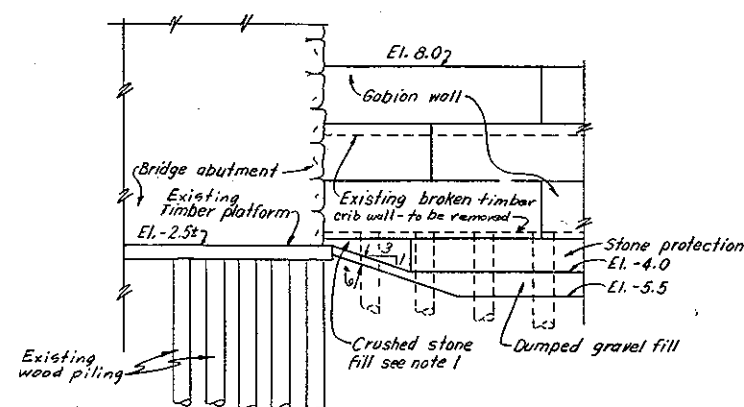
EXCAVATION PLAN

SCALE 1" = 4'



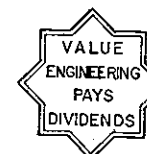
SECTION A-A

SCALE 1" = 4'

NOTE 1: Crushed stone fill  
ends at face of abutment

SECTION B-B

SCALE 1" = 4'



GRAPHIC SCALES



As Built Drawing

Contract No. DACW33-77-C-0086

|   |  |   |
|---|--|---|
| 7-14-78 Final field corrections   |  |   |
| REVISION  | DATE   | DESCRIPTION   |
| 1   | 7-13-78  | Pipe size changed (Am. #1)  |
| DEPARTMENT OF THE ARMY<br>NEW ENGLAND DIVISION<br>CORPS OF ENGINEERS<br>WALTHAM, MASS.  |  |   |
| WATER RESOURCES DEVELOPMENT PROJECT<br>MERRIMACK RIVER BASIN<br>STABILIZATION OF RIVER BANK<br>GABION WALL AT BRIDGE ABUTMENT |  |   |
| DESIGNED BY<br>Checked by<br>Reviewed by<br>Approved by   | AMESBURY<br>MASSACHUSETTS<br>DATE<br>JUNE 1977 | APPROVED<br>SPECIAL AGENT IN CHARGE<br>SCALE 1" = 4'<br>DRAWING NUMBER<br>MER-33<br>SHEET 3 |